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UNITED STATES OF AMERICA

Working Paper Comparing Nerve Agent Facilities and Civilian Chemical Production Facilities

1. A working paper submitted by the United States delegation on March 16, 1970 (CCD 283) described the complex relationship between the production of chemicals for peaceful purposes by commercial chemical industries and the production of chemical agents for war. Another question related to a comprehensive ban on chemical weapons and also requiring further study is the extent of the external similarity between plants producing chemical weapons and plants producing industrial and commercial chemical products. In this paper the question is examined with respect to the production of nerve agents.

2. The chemical processing industry encompasses the conversion of various chemical raw materials into usable products of all descriptions. Chemical process plants through-out the world range in production rate from a few hundred pounds to several million pounds of finished product a year, and in area from a few thousand square feet to several thousand acres. The production of chemical nerve agents involves a chemical process in which the production facilities and equipment utilized are similar to the equipment and processes used by a major segment of the world chemical industry. With the advent of highly complex, inter-related chemical complexes, it is also possible that a wide variety of chemical products, including nerve agents, could be produced within a single chemical complex.

3. The US has undertaken as a part of its research programme to examine whether it would be possible by "off-site observation," either from the air or from the ground, to determine whether a particular chemical processing facility or complex was producing, or was capable of producing, lethal nerve agents. Three United States chemical processing plants that are similar in size and general appearance were examined by external inspection. The first of these plants is a cryogenic (low-temperature) natural-gas processing plant; the second is a high-energy fuel facility; and the third (the Newport Chemical Plant), is a VX nerve-agent production facility. The three plants were examined on the basis of general external appearance, e.g. raw-material input, storage facilities, consumption of utilities, and waste disposal, and more specifically on the basis of process equipment and safety features.

4. Raw Material Input - With respect to rail and truck deliveries, it was concluded that aerial observation cannot determine what materials are being supplied to the facility. Moreover, since many of the same basic raw materials used in producing nerve agents, e.g., elemental phosphorus, chlorine, and various petrochemicals, are widely used in commercial production, the identification of some deliveries, even if possible, would not in itself indicate that nerve agents, rather than plasticizers or pesticides, were being produced in the plant. In fact, observation of the containers used in shipping might not even indicate in a general way which of hundreds of chemicals or gases were being transported to the plant. (See paragraph 5 below).

5. Storage Facilities - The raw materials and the intermediate and end products commonly stored in the chemical process industry can be in solid, liquid, or gaseous forms. In all three forms materials can be stored in bulk or in unit containers, outdoors or under shelter. Unit containers are indistinguishable from facility to facility. Solid bulk materials are stored both outdoors and indoors in piles or in bins or bunkers. The bulk storage of all types of liquid materials is, of course, generally carried out in some form of tank, vertical, horizontal, rectangular, or spherical in shape. Tanks are constructed of metal, wood or concrete, and their storage capacity can range from 200 to 1 million gallons. Liquid materials can also be stored in barrels, kegs, drums, cans or glass containers, generally holding less than 75 gallons. Gases stored in bulk are also usually contained in tanks. The most common types of readily observable containers are the large spherical, cylindrical, or horizontal tanks which are used throughout the chemical industry to hold hundreds of different chemicals and gases. These same kinds of containers are also used in nerve agent production.

6. Utilities - The utilities requirements for nerve-agent production are not greatly different from those of regular chemical operations. Electrical power may be required in greater than normal amounts but not to a degree which is unique. This requirement and the more normal water requirement could affect the location of a plant. The availability of large amounts of these utilities to a plant would not, however, be a particular indicator of nerve-agent production since location of industrial chemical facilities near ample electrical and water supplies is common practice.

7. Wastes - The nontoxic wastes of a nerve-agent plant would be similar to those produced by some industrial chemical plants. On the other hand, the chemical waste from the final unit processes for nerve-agent production requires neutralization and

detoxification before it enters the final waste disposal system. Analysis of disposed materials might provide some indication of nerve-agent production, but this could not be done by off-site observation; rather on-site sampling with extremely sensitive instruments would be required. Disposal of toxic wastes is not, of course, a problem peculiar to nerve-agent manufacture.

8. Process Equipment - There are many basic types of chemical processing equipment used for the production of both nerve agents and industrial chemicals, and these basic types can often be converted from the manufacture of one chemical to another, with varying degrees of ease. While this equipment can often be readily observed from outside the plant, very little can be determined about its function or rate of operation.

a. Distillation equipment - Distillation is one of the fundamental processes used to separate a specific chemical or group of chemicals from a mixture. Separation is accomplished in what are generally referred to as distillation columns. These are vertical, cylindrical vessels whose height is usually much greater than their diameter. They range in size from less than 1 foot in diameter and 10 feet in height to more than 15 feet in diameter and 300 feet in height. It is not possible to identify by outside observation the processes taking place within the column. In many chemical plants, distillation columns, like other pieces of equipment, are frequently used in processes other than the one for which they were originally designed.

b. Furnaces - Furnaces are one of the principal components of chemical processing facilities. These industrial furnaces are found in a great variety of sizes and designs, and there is no particular type which would be characteristic of nerve-agent plants.

c. Reactors - A reactor is the processing vessel in which chemical reactions take place. Reactors of all shapes, sizes and configurations are used in the chemical industry, depending upon the specific process in which they are to be used. Some reactors differ only slightly from small storage tanks and small heat exchangers. Reactors can differ substantially in size and shape even though they are designed for similar processes. Again, there is no shape or other characteristic which is unique to nerve-agent production.

d. Scrubbers - There is a rather large variety of equipment generally referred to as scrubbers for the separation of solids, liquids, or specific gases from air or from a gas stream by using water to scrub out the unwanted materials. These scrubbers are

vertical, cylindrical vessels with a relatively large height-to-diameter ratio. The size of the scrubber depends on the amount of air that must be treated. External observation does not reveal the materials that are being treated within the scrubber, and almost any size or shape might be used in a nerve-agent plant.

e. Flare Stacks - These are tall thin towers, up to several hundred of feet high, containing at their centres pipes which carry waste gases to the top where they are burned in the atmosphere. Although flare stacks are highly visible, their appearance would provide no means of distinguishing one plant from another.

9. Safety - Because of the highly lethal nature of the agents being produced, a nerve-agent plant requires special safety measures. In particular, the containment of toxic chemicals requires rigid control of plant air. Air coming out of the toxic process area would need to be scrubbed to remove any toxic materials, and precautions would need to be taken to prevent any air from flowing out of the toxic process area into the non-toxic operating areas. Access between the toxic and non-toxic areas would require special controls such as airlocks. Personnel entering the toxic process area would have to wear masks and protective clothing. Such features, however, would not be observable from outside the plant, since they all pertain to operations within closed structures.

10. Summary - Our research indicates that the problem of identification of nerve-agent production facilities cannot be solved by off-site observation. Chemical process facilities are to be found in numerous locations throughout the world which contain many of the same raw materials, processes, operations, equipment, and support installations as those required to produce nerve agents.